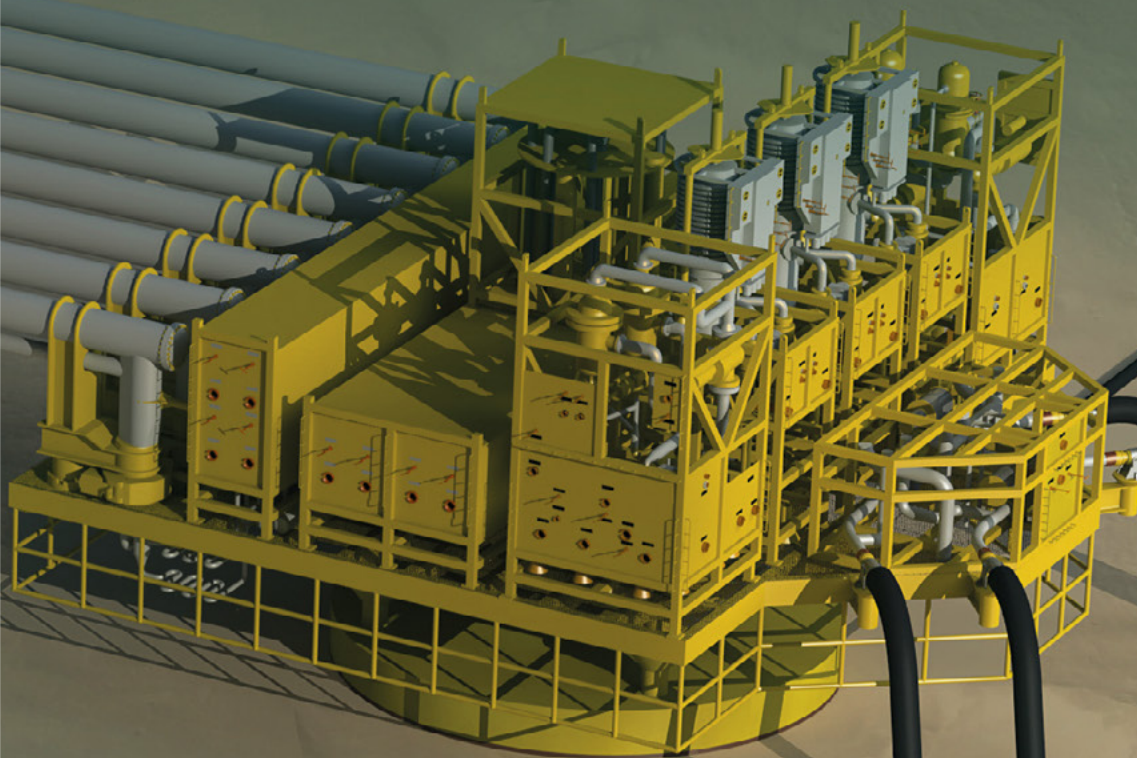


SAIPEM SPOOLSEP

SUBSEA GRAVITY
LIQUID-LIQUID SEPARATOR



SAIPEM

SPOOLSEP: SUBSEA GRAVITY LIQUID-LIQUID SEPARATOR

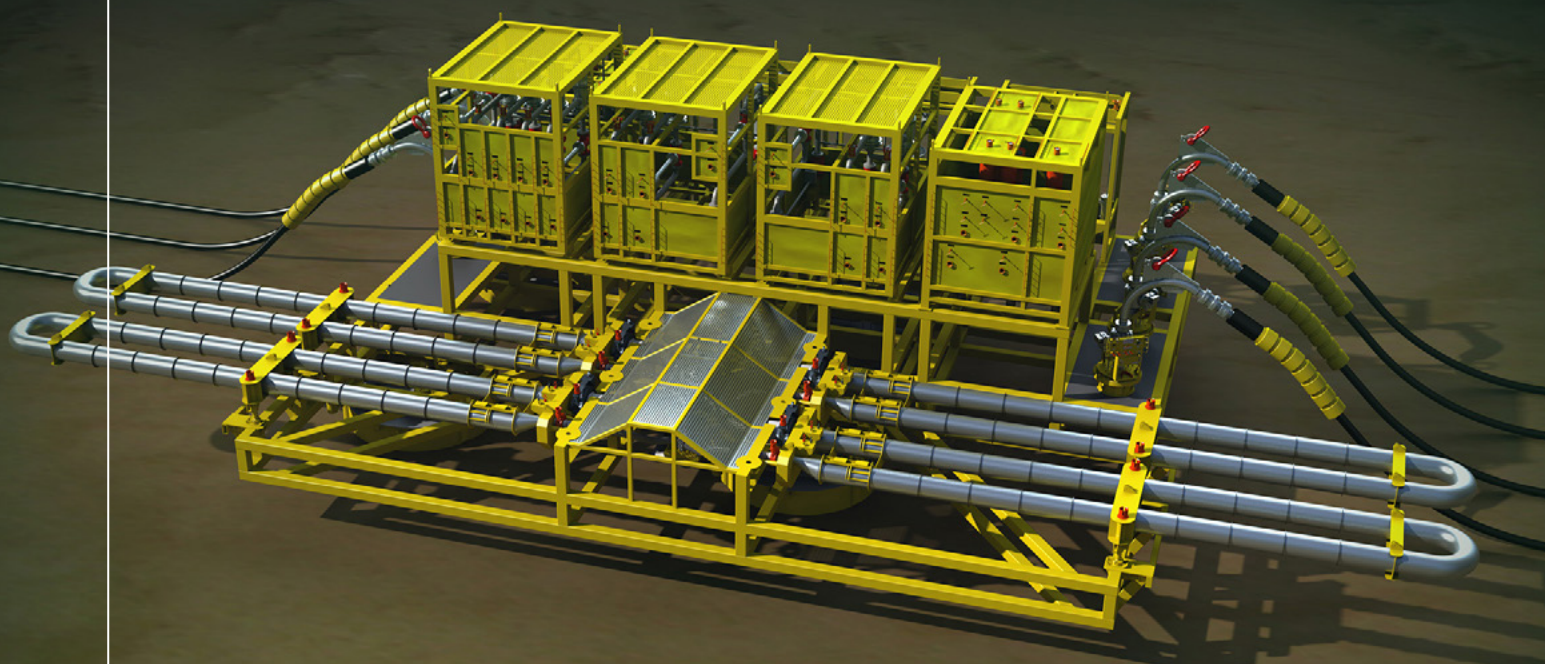
A process solution to remove and reinject or dispose produced water for deep and ultra-deep waters and/or high pressure applications

Subsea produced water separation and reinjection is a way to maximize oil recovery. Saipem is developing the SpoolSep, an innovative liquid-liquid separator made from several parallel horizontal pipes.

THE SUBSEA STATION TREATMENT STAGES

└ The SpoolSep for subsea bulk water separation
Several pipes working in parallel. Based on gravity separation with long residence time for better separation efficiency.

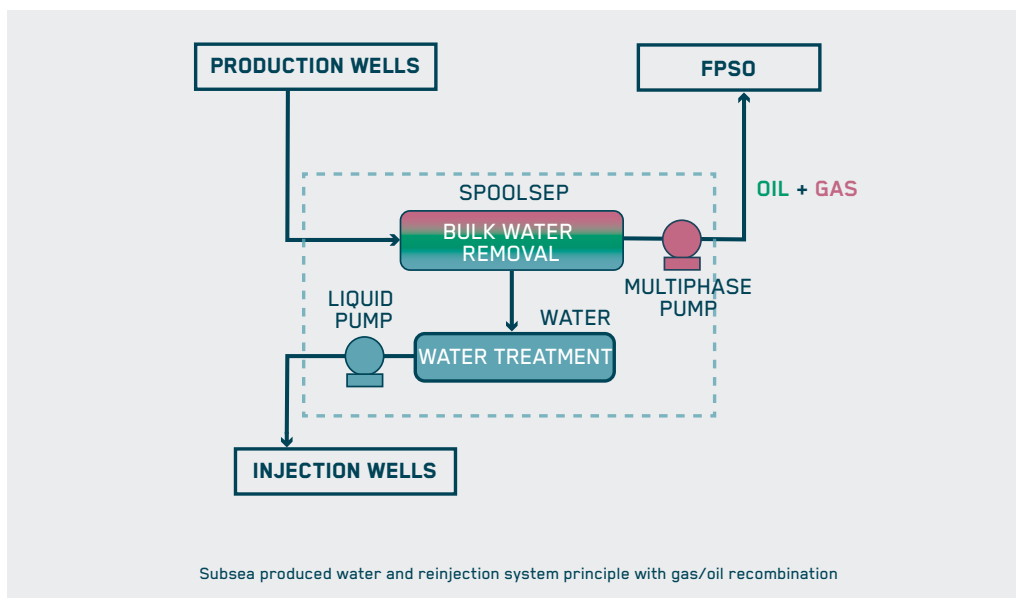
└ Produced water treatment desanding cyclones, pumped deoiling cyclones and Compact Flootation unit.



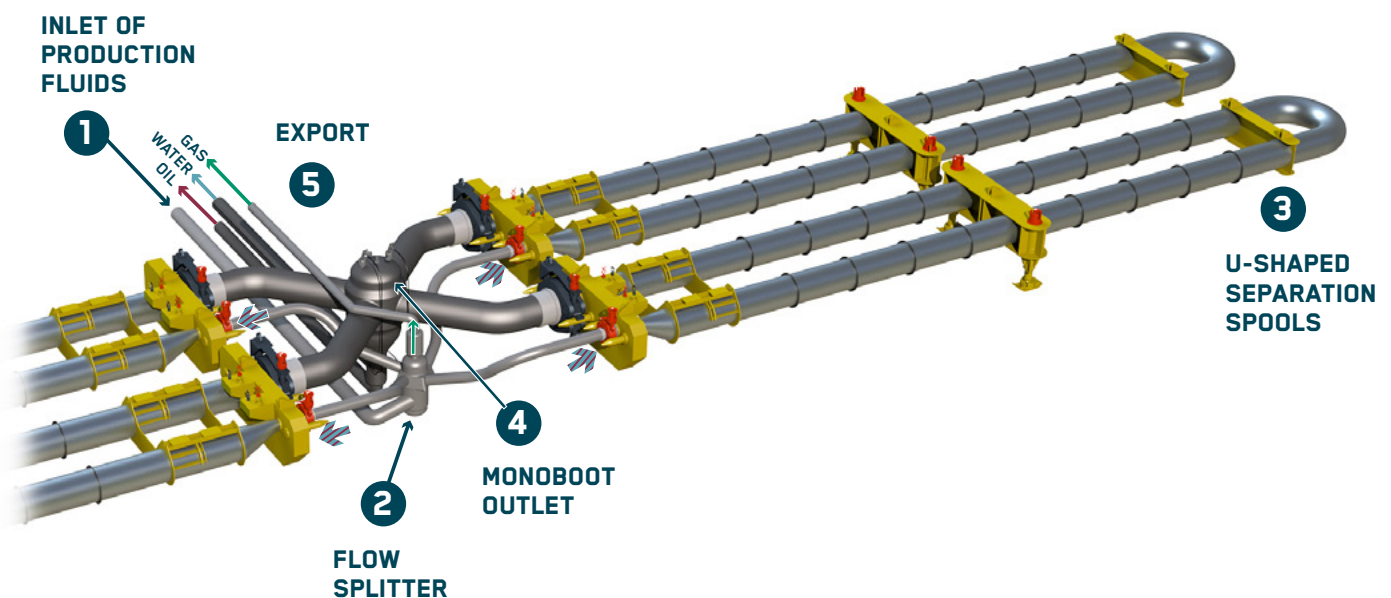
BENEFITS OF THE TECHNOLOGY

- Increase oil recovery by decreasing the well head back pressure.
- Subsea water debottlenecking (mature fields) allowing tie-back of new wells.
- Robust and reliable separation process.
- Can also be designed for 3-phase separation.
- Good slug handling capabilities.
- A flexible design to cope with a wide range of applications and requirements (high pressure, high flowrate, etc.).
- Modular system design allowing easy maintenance and intervention.
- Allow maximization of local fabrication and assembly.

Water treatment in cooperation with  **VEOLIA**



SPOOLSEP PRINCIPLE



TYPICAL OPERATING CONDITIONS

DESIGN DATA	TYPICAL PERFORMANCES
Liquid flowrate: 50 to 120 kbpd	Oil in water:
GVF: 0 to 80%	1,000 to 2,000 downstream first stage
Water cut: 30 to 95%	29 ppm downstream PWT stages
Design pressure: 5,000 to 10,000 psi	
Water depth: down to 4,000 m	

QUALIFICATION PROGRAM

Tests performed to qualify

- The distribution system
- The overall operability and control of the separator
- Design criteria for separation performances
- Internals and outlet design options

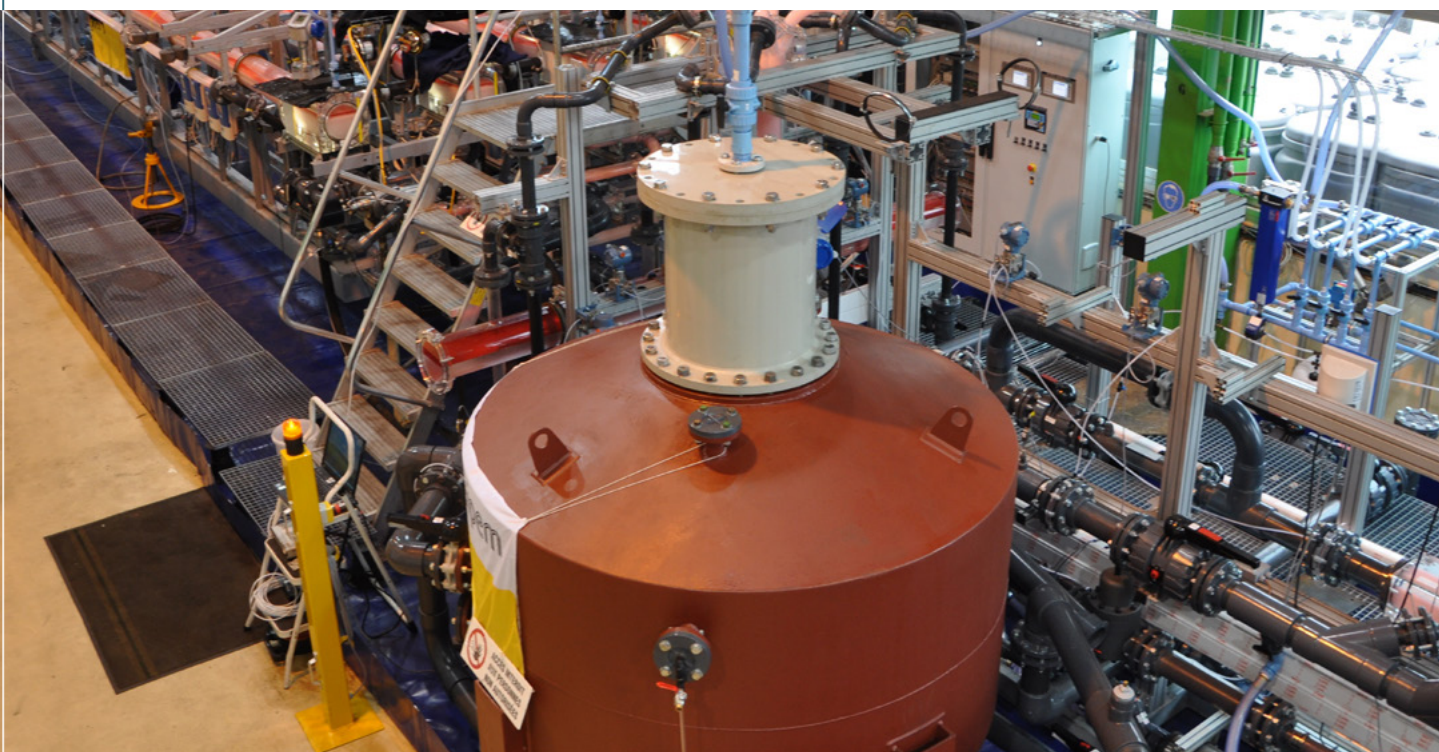
Tests in a multiphase loop at CETIM Nantes

- Model scale: 1/2.8, plexiglas, 4 pipes (ID=0.2 m, L=18 m)
- Testing loop at atmospheric conditions with air, water, model oils
- Tests performed with variation of
 - Fluid properties
 - Flowrates (WC, GVF, flow patterns)
 - Inlet shear/mixing energy
 - Water level set point
 - Spool inclination

- Measurements of
 - Water/oil interface and level
 - Mass flowrates for each phase
 - Pressure and temperature
 - Liquid viscosity
 - Oil in water content with oil droplet size
 - Water in oil content

JIP performed in partnership with Total and Petrobras

- Subsea station conceptual design on business cases
 - Tests (additives in oils, u-shaped pipes)
 - Feasibility study of subsea water removal to enable cold export
- SpoolSep design optimized for lighter and cheaper configuration.





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LET'S KEEP IN TOUCH

